

# PATENT ABSTRACTS OF JAPAN

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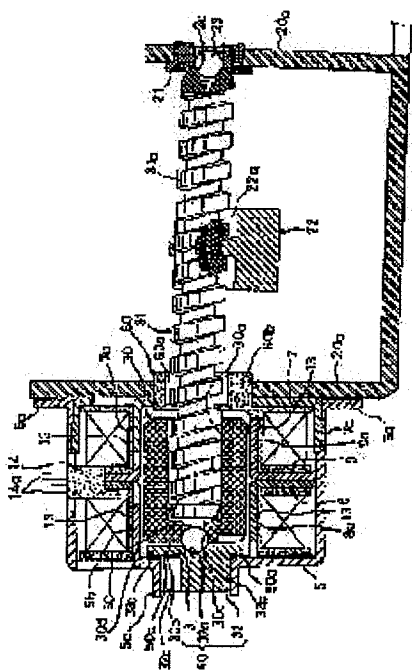
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## (54) SCREW-FEEDING MOTOR



### (57)Abstract:

PROBLEM TO BE SOLVED: To provide a screw-feeding motor which can use a screw shaft with a small diameter and realize cost reduction.

SOLUTION: A screw-feeding motor has a screw shaft 31, whose base end side is pushed into a cylindrical hole 30a of a PM-type inner rotor 30 and which has a male screw part 31a over its entire length. The shaft 31 is a rolled screw shaft, obtained by cutting a rolled screw rod to a prescribed length. The PM-type inner rotor 30 is a bottomed cylindrical unit, which has a thrust bearing mechanism 40 regulating the rotating center of the outer surface of its bottom 30b and a ring plate 50 which elastically biases the PM-type inner

rotor 30 consistently via the thrust bearing mechanism 40 in the axial direction. Since it is not necessary to form a ball receptacle hole in the end surface of the screw shaft itself by cutting machining, the cost reduction can be realized. Furthermore, since a screw shaft with a small diameter which is not suitable for cutting machining can be employed, this contributes to reduction in size of the motor.

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## CLAIMS

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[Claim(s)]

[Claim 1] In a motor for screw delivery provided with a screw shaft which has an external thread part in an other end side portion which carries out fit-in immobilization of the one end side at a tubiform hole of PM form inner rotor, and can be projected out of a motor body at least, A motor for screw delivery which said PM form inner rotor has an elasticity thrust-block means which is a cylinder-like-object-with-base-like object, carries out alignment regulation of the center of rotation of the external bottom, and carries out elastic energization of said PM form inner rotor to shaft orientations, and is characterized by things.

[Claim 2] Claim 1 comprising:

A thrust-block means which said elasticity thrust-block means applies an alignment ball in the center by the side of said external bottom, and carries out thrust support of said PM form inner rotor.

An elastic energization means which always carries out elastic energization of said PM form inner rotor to said shaft orientations via this thrust-block means.

[Claim 3] Claim 2 comprising:

A ball receiver hole of approximately tapered shape which formed said thrust-block means in the center of said external bottom.

Said alignment ball stored in this ball receiver hole.

A ball presser foot which possesses a ball spot hole of approximately tapered shape of a \*\*\*\*\* sake for said alignment ball to shaft orientations.

[Claim 4] A motor for screw delivery characterized by a solid angle of said ball receiver hole being larger than a solid angle of said ball spot hole in claim 3.

[Claim 5] A motor for screw delivery which said PM form inner rotor has a penetrated part which opens said ball receiver hole and said tubiform hole inside for free passage to shaft orientations in claim 3 or claim 4, and is characterized by things.

[Claim 6] A motor for screw delivery which said screw shaft

penetrates into an end of said motor body loosely by a loose penetration crevice, has a motor attaching part by which a fitting position arrangement is carried out in an attaching hole of the 1st base material outside the plane in any 1 paragraph of claim 1 thru/or claim 5, and is characterized by things.

[Claim 7]A motor for screw delivery, wherein integral moulding of said motor attaching part is simultaneously carried out by mold resin material unified by insert molding between yokes and it changes in claim 6.

[Claim 8]A motor for screw delivery characterized by said screw shaft being a form-rolling screw shaft which cut and used form-rolling screw bar material for \*\*\*\*\* in any 1 paragraph of claim 6 or claim 7.

[Claim 9]A motor for screw delivery which attaches a crown object which a surface-of-a-sphere journal part which should constitute the bearing surface outside the plane and pivot bearing of the 2nd base material projected in one in any 1 paragraph of claim 1 thru/or claim 8 to a tip part by the side of said other end of said screw shaft, and is characterized by things.

[Claim 10]A motor for screw delivery characterized by said PM form inner rotors being plastic magnet mold goods in any 1 paragraph of claim 1 thru/or claim 9.

[Claim 11]A motor for screw delivery, wherein said ball presser foot is fabricated with slippage plastic material and changes in any 1 paragraph of claim 3 thru/or claim 10.

[Claim 12]A motor for screw delivery, wherein said crown object is fabricated with slippage plastic material and changes in any 1 paragraph of claim 9 thru/or claim 11.

[Claim 13]A motor for screw delivery characterized by said ball spot hole of said ball presser foot of said elastic energization means being a ring plate which has in one two or more letter plate spring pieces of radiation which a tip part welds by pressure by abbreviation regular intervals, respectively towards a center in the circumference of a central area of an opposite side in any 1 paragraph of claim 3 thru/or claim 12.

[Claim 14]An electrically powered equipment which is provided with a screw delivery mechanism characterized by comprising the following, and is characterized by things.

A motor for screw delivery specified in any 1 paragraph of claim 1

thru/or claim 13.

A follower member screws in said screw shaft and screw delivery is carried out to shaft orientations by the rotation of.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the motor for screw delivery whose shaft is a screw shaft especially about the motor for screw delivery used for the zoom mechanism of head seek mechanisms, such as a floppy disk drive, a still camera, and a video camera, etc.

[0002]

[Description of the Prior Art] Conventionally the small stepping motor for screw delivery used for the head seek mechanism of a floppy disk drive, As shown in drawing 5, fit-in immobilization of the one end side is carried out at the tubiform hole of the PM form (permanent magnet form) inner rotor 1, and the screw shaft 2 which used as the external thread part 2a the other end side portion which projects out of a motor body is provided. The tapered shape ball receiver hole 2c is formed in the end surface of this screw shaft 2 for tapered shape ball receiver hole 2b again also at the apical surface of the external thread part 2a. The flat spring 4 which always carries out suppression energization of the steel ball 3 stored in this ball receiver hole 2b from the one end side of the screw shaft 2 to the other end side is formed in the bottom of the cup shape outer yoke 5 of a case and. It has prevented with the backlash of the shaft orientations of the screw shaft 2 (backlash of a screw). The steel ball 3 is used here in order to reduce the sliding loss by the flat spring 4. The lid-like outer yoke 7 which plugs up the opening of the cup shape outer yoke 5 is inserted in the bearing metal 6 which slides on it and carries out the receptacle of the halfway peripheral surface of the screw shaft 2. The motor body side inserts the bearing metal 6 in the attaching hole of the raised piece 20a of the frame of a floppy disk drive, and screws the flange 5a of the cup shape outer yoke 5 on. The external thread part 2a side shows the ball receiver hole 2c to

spite the steel ball 23 of the bearing 21 which was cut and was inserted in the attaching hole of the piece 20b of a lifting. Both-way \*\*\*\*\* of the head carriage 22 with the internal thread part 22a screwed in it by rotation of the screw shaft 2 is carried out in shaft orientations.

[0003]

[Problem(s) to be Solved by the Invention]However, if it was in the above-mentioned motor for screw delivery, there were the following problems.

[0004]\*\* Although ball receiver hole 2b and 2c needed to be formed in the both-ends side of the screw shaft 2 used for the motor for screw delivery, since such ball receiver hole 2bs and 2c were formed by cutting, they had become about the obstacle of formation of a narrow diameter shaft, or low-cost-izing.

[0005]\*\* Since axial center maintenance of the screw shaft 2 was performed using the plain-bearing metal 6, the sliding loss by the metal 6 arose and it had become a factor of torque loss again.

[0006]Then, in view of the above-mentioned problem, there is the 1st technical problem of this invention in providing the motor for screw delivery which it is possible to use the screw shaft of a narrow diameter, and can realize low cost-ization.

[0007]There is the 2nd technical problem of this invention in providing the motor for screw delivery which axial center maintenance of a screw shaft is possible, and can realize reduction of sliding loss without using radial sliding bearing.

[0008]

[Means for Solving the Problem]In a motor for screw delivery provided with a screw shaft which has an external thread part in an other end side portion which carries out fit-in immobilization of the one end side at a tubiform hole of PM form inner rotor, and can be projected out of a motor body at least since the 1st technical problem of the above is solved, The above-mentioned PM form inner rotor has an elasticity thrust-block means which is a cylinder-like-object-with-base-like object, carries out alignment regulation of the center of rotation of the external bottom, and carries out elastic energization of the above-mentioned PM form inner rotor to shaft orientations.

[0009]Since the tip side of a screw shaft is what is supported by a thrust block from the first in the case of attachment of a motor

for screw delivery, Like this invention, axial center maintenance is possible at the end face side of a screw shaft, i.e., structure which carries out thrust support of the cylinder-like-object-with-base-like object of PM form rotor magnet by an elasticity thrust-block means. A end face of a screw shaft is not supported movably by an elasticity thrust-block means like before, Since it is the structure which supports movably a pars basilaris ossis occipitalis of a cylinder-like-object-with-base-like object of PM form rotor magnet, it is not necessary to form a ball receiver hole in the end face of the screw shaft itself by cutting, and structure of a ball receiver hole for alignment regulation, etc. can be provided in a pars basilaris ossis occipitalis of a cylinder-like-object-with-base-like object thicker than a path of a screw shaft. A part and low-cost-izing which can eliminate cutting by the side of a end face of a shaft are realizable.

[0010]Since a screw shaft of a narrow diameter unsuitable for cutting can also be used, it contributes to a miniaturization of a motor.

[0011]It has a thrust-block means which applies an alignment ball in the center by the side of the above-mentioned external bottom, and carries out thrust support of the PM form inner rotor as this elasticity thrust-block means, and an elastic energization means which always carries out elastic energization of the PM form inner rotor to shaft orientations via this thrust-block means.

[0012]And this thrust-block means has a ball receiver hole of approximately tapered shape formed in the center of an external bottom, an alignment ball stored in this ball receiver hole, and the ball presser foot which possesses a ball spot hole of approximately tapered shape of a \*\*\*\*\* sake for an alignment ball to shaft orientations. A function to hold an axial center of PM form rotor magnet, i.e., a screw shaft, (alignment regulation) is exhibited.

[0013]In the above-mentioned thrust-block means, it is preferred here that a solid angle of a ball receiver hole by the side of PM form rotor magnet is larger than a solid angle of a ball spot hole. Since the osculating circle of an alignment ball and a ball receiver hole is larger than an osculating circle of an alignment ball and a ball spot hole, when a coefficient of friction is generally made equivalent in this case, an alignment ball is

immobilization to a ball receiver hole, and an alignment ball will slide on it and turn around a ball spot-hole top. Since an alignment ball does not move to PM form rotor magnet, it is hard to produce wear of a magnet. If PM form rotor magnet uses a plastic magnet especially, a coefficient of friction will become large and it will become difficult to slide on the part, an alignment ball, and PM form rotor magnet. If the ball spot-hole side is fabricated with a slippage plastic, an alignment ball will not move to PM form rotor magnet still more.

[0014]Having a penetrated part which opens a ball receiver hole and the tubiform hole inside for free passage to shaft orientations has [ PM form rotor magnet ] preferred things. This penetrated part can be used as a feed hole (grease \*\*\*\*\*). Since an alignment ball adheres to grease in a penetrated part, it becomes still more difficult to move an alignment ball to PM form rotor magnet.

[0015]Next, in order to solve the 2nd technical problem of the above, in the above-mentioned composition at in addition, the end of the above-mentioned motor body. A screw shaft penetrates loosely by a loose penetration crevice, and according to composition which has a motor attaching part by which a fitting position arrangement is carried out in an attaching hole of the 1st base material outside the plane, since a motor attaching part is non-contact, it can reduce sliding loss to a peripheral surface of a screw shaft, and contributes to improvement in output torque at it. And even if not only when only an other end side portion which can be projected out of a motor body among screw shafts is an external thread part, but a shaft overall length is an external thread part, it does not interfere again. Since it becomes possible to use a form-rolling screw shaft which cut form-rolling screw bar material to \*\*\*\*\* in this case, cutting screw processing can be eliminated and large low cost-ization can be realized. Since the length of an external thread part which projects by changing the depth which presses a screw shaft fit in PM form rotor magnet especially is changeable, low cost-ization is also realizable by common use of a screw shaft.

[0016]Since the tip side of a screw shaft is what is supported by a thrust block in the case of attachment of a motor for screw delivery as mentioned above, axial center maintenance is possible also with structure which carries out thrust support of the cylinder-like-object-with-base-like object of PM form rotor magnet

by an elasticity thrust-block means.

[0017]If integral moulding of the above-mentioned motor attaching part is simultaneously carried out here by mold resin material unified by insert molding between yokes and it grows into it, it contributes to reduction of part mark and much more low cost-ization can be realized.

[0018]Attaching a crown object which a surface-of-a-sphere journal part which should constitute the bearing surface outside the plane and pivot bearing of the 2nd base material projected in one to a tip part by the side of the other end of the above-mentioned screw shaft has preferred things. As well as the ability to eliminate cutting of a ball receiver hole by the side of the other end of a screw shaft, since the covering object itself possesses a surface-of-a-sphere journal part in one, it contributes to reduction of part mark and low cost-ization can be realized.

[0019]As for this crown object, it is preferred for it to be fabricated with slippage plastic material and to change. It contributes to reducing friction of a surface-of-a-sphere journal part.

[0020]As the above-mentioned elastic energization means, a ball spot hole of a ball presser foot is a ring plate with which a tip part has in one two or more letter plate spring pieces of radiation welded by pressure, respectively towards a center by abbreviation regular intervals in the circumference of a central area of an opposite side. Since it is adding to the circumference of a central area of a ball presser foot by energizing force in which two or more letter plate spring pieces of radiation carried out equivalent and-izing of the posture of a ball presser foot itself can be carried out [ \*\* 1 ] with an axis, highly precise axial center maintenance is realizable.

[0021]And it has a follower member screws in a motor for screw delivery which was mentioned above, and its screw shaft, and screw delivery is carried out to shaft orientations by the rotation of, and is suitable for using a screw delivery mechanism for electrically powered equipments, such as a floppy disk drive, a still camera, and a video camera.

[0022]

[Embodiment of the Invention]Next, each embodiment of this invention is described based on an accompanying drawing.



[0023][Embodiment 1] Drawing 1 is a vertical section side view showing the screw delivery mechanism using the motor for screw delivery concerning Embodiment 1 of this invention. The portion and identical parts which are shown in drawing 5 attach the same reference mark, and omit the explanation.

[0024]The motor for screw delivery of this example (small stepping motor) presses the end face side fit in the tubiform hole 30a of the PM form inner rotor 30, and has the screw shaft 31 which has the external thread part 31a in an overall length. This screw shaft 31 is a form-rolling screw shaft which cut and used form-rolling screw bar material for \*\*\*\*\*. The PM form inner rotors 30 are plastic magnet mold goods, such as NEOJI or samarium iron Chisso, and serve as a cylinder-like-object-with-base-like object. And it has with the thrust-block mechanism 40 which carries out alignment regulation of the outside center of rotation of the pars basilaris ossis occipitalis 30b of a cylinder-like-object-with-base-like object, and the elastic energization means slack ring plate 50 which always carries out elastic energization of the PM form inner rotor 30 to shaft orientations (the direction of a tip of the screw shaft 31) via this thrust-block mechanism 40.

[0025]The ball receiver hole 30c of approximately tapered shape which the thrust-block mechanism 40 applied the alignment ball (steel ball) 3 in the center of the outside surface side of the pars basilaris ossis occipitalis 30b, and carries out thrust bearing and formed the PM form inner rotor 30 in the central area of the outside surface of the pars basilaris ossis occipitalis 30b, It has the alignment ball 3 stored in this ball receiver hole 30c, and the ball presser foot 32 which possesses the ball spot hole 32a of approximately tapered shape of a \*\*\*\*\* sake for that alignment ball 3 to shaft orientations.

[0026]Here, the solid angle (about 120 \*\*) of the ball receiver hole 30c of the PM form inner rotor 30 is larger than the solid angle (about 60 degrees) of the ball spot hole 32a of the ball presser foot 32. In the PM form inner rotor 30, the penetrated part 30d which opens the ball receiver hole 30c and the tubiform hole 30a inside for free passage to shaft orientations is formed. This penetrated part 30d is used as grease \*\*\*\*\*. The ball presser feet 32 are mold goods of slippage plastic material.

[0027]The ball presser foot 32 is an integrally molded product of

the fitting part 32b inserted in the tubiform hole of the diaphragm tubed part 5a which projects on the bottom of the cup shape outer yoke 5 of a case and so that shaft-orientations idle movement is possible, and the collar-like part 32c which carries out a slip off stop. As shown in drawing 2 (A) and drawing 3, 32 d of location notches corresponding to two or more letter plate spring pieces 50a of radiation of the ring plate 50 are formed in the fitting part 32b. The ring plate 50 is positioned by \*\*\*\* (clo pole) 5b of five poles started inside from the bottom of the cup shape outer yoke 5, It has in one [ centering on two or more letter plate spring pieces 50a of radiation which fit into 32 d of location notches, and a tip part welds by pressure to the circumference of a central area of the collar-like part 32c by abbreviation regular intervals, respectively ].

[0028]The outer stator of a motor body is provided with the following.

The lid-like outer yoke 7 which has \*\*\*\* (clo pole) 7a of five poles started inside as the opening of the \*\* cup shape outer yoke 5 is shown in \*\*\*\* and drawing 2 (B) outside the above-mentioned cup shape outer yoke 5.

The crown-like 1st inner yoke 8 in which \*\*\*\* 8a is positioned between the \*\*\*\* 5b within the cup shape outer yoke 5

The crown-like 2nd inner yoke 9 in which \*\*\*\* 9a is positioned between \*\*\*\* 7a of the lid-like outer yoke 7 within the cup shape outer yoke 5

The coil coil 11 which constitutes an A phase, and the coil coil 12 which constitutes a B phase.

The 1st inner yoke 8 and 2nd inner yoke 9 are unified with the mold resin 13 by insert molding, and the mold resin 13 is also making the insulating layer serve a double purpose. At the time of insert molding, the terminal block 14 and the motor attaching part 60 are simultaneously formed with the mold resin 13. The terminal pin 14a stands erect in the terminal block 14.

[0029]In the end of a motor body, the screw shaft 31 penetrates loosely by the loose penetration crevice 60a, and the fitting position arrangement of the motor attaching part 60 made of this resin is carried out in the attaching hole of the raised piece 20a of a frame. The motor attaching part 60 has the locating lug 60b which fits in between \*\*\*\* 7a of the lid-like outer yoke 7.

[0030] Since thrust support of the tip side of the screw shaft 31 is carried out by the ball receiver hole 2c, the steel ball 23, and the bearing 21 when using the motor for screw delivery of such composition for the screw delivery mechanism shown in drawing 1, like this example, only the thrust-block mechanism 40 is provided in the end face side, and the conventional metal bearing 6 is not provided. Reduction of part mark can be aimed at. In this example, since it is not necessary to form a ball receiver hole in the end face side of screw shaft 31 the very thing by cutting and, and it is the structure which supports movably the pars basilaris ossis occipitalis 30b of the cylinder-like-object-with-base-like object of the PM form rotor magnet 30 and a cheap form-rolling screw shaft can be used, low cost-ization is realizable. The direction which forms the ball receiver hole 30c for alignment regulation in the pars basilaris ossis occipitalis 30b of a cylinder-like-object-with-base-like object thicker than the path of the screw shaft 31 by resin molding can carry out [ cheap ]-izing of the manufacturing cost. It contributes to the miniaturization of a motor.

[0031] Since the solid angle of the ball receiver hole 30c by the side of the PM form rotor magnet 30 has size-come to come rather than the solid angle of the ball spot hole 32a of the ball presser foot 32, and the osculating circle by the side of the ball receiver hole 30c is larger than the osculating circle of the ball spot hole 32a, a slide is produced between the alignment ball 3 and the ball spot hole 32a. Therefore, since the alignment ball 3 does not move to the PM form rotor magnet 30, it is hard to produce wear of the magnet 30. In particular, since the PM form rotor magnets 30 are plastic magnets, such as NEOJI, a coefficient of friction becomes large, and it becomes difficult to slide on the part, the alignment ball 3, and the PM form rotor magnet 30, and is convenient. In addition, since the ball presser foot 32 is a slippage plastic, between the PM form rotor magnet 30 and the alignment ball 3, it is still more hard to produce sliding. And since the penetrated part 30d is used as a feed hole (grease \*\*\*\*\*), it adheres to the alignment ball 3 at grease, and to the peripheral surface of the screw shaft 31, since the motor attaching part 60 is non-contact, it can reduce sliding loss, and contributes to improvement in output torque again. Since it is non-contact, the form-rolling screw shaft 31 whose shaft overall length is an external thread

part about the screw shaft 31 can be used, and much more low cost-ization can be realized. Since the length of the external thread part 31a which projects by changing the depth which presses the screw shaft 31 fit in the PM form rotor magnet 30 especially is changeable, The screw shaft 31 can be shared to the screw feed motor with which the length of the external thread part 31a differs, and low cost-ization can also be realized.

[0032]Integral moulding of this motor attaching part 60 is simultaneously carried out by the yoke 8 unified by insert molding, and the mold resin material between nine, and it changes. Therefore, it contributes to reduction of part mark etc. and much more low cost-ization can be realized. The lid-like outer yoke 7 may also be simultaneously unified by the above-mentioned insert molding. It contributes to reduction of an attachment man day.

[0033]The tip part has the ring plate 50 in one [ centering on two or more letter plate spring pieces 50a of radiation welded by pressure, respectively ] by abbreviation regular intervals around [ central area ] the opposite side of the collar-like part 32c of the ball presser foot 32. Since it is adding to the circumference of a central area of the ball presser foot 32 by the energizing force in which two or more letter plate spring pieces 50a of radiation carried out equivalent and-izing of the posture of the ball presser foot 32 itself can be carried out [ \*\* 1 ] with an axis, highly precise axial center maintenance is realizable.

[0034][Embodiment 2] Drawing 4 is a vertical section side view showing the screw delivery mechanism using the motor for screw delivery concerning Embodiment 2 of this invention. The portion and identical parts which are shown in drawing 1 attach the same reference mark, and omit the explanation.

[0035]It is in the place which attaches the crown object 70 which the surface-of-a-sphere journal part 71 which should constitute the bearing 23 which was cut to the tip part of the screw shaft 31, and was inserted in it as a feature of this example in the attaching hole of the piece 20b of a lifting, and pivot bearing projected in one. This crown object 70 is mold goods of slippage plastic material. Since cutting by the side of the tip of the screw shaft 31 can also be eliminated and it will become unnecessary [ the steel ball 23 ] if such a crown object 70 is used, much more low cost-ization is realizable. Since slippage plastic material is used,

it contributes to reducing friction. The operation effect of others of this example is the same as that of Embodiment 1.

[0036]The screw delivery mechanism using a motor for screw delivery which was mentioned above is suitable for using for electrically powered equipments, such as a floppy disk drive, a still camera, and a video camera.

[0037]

[Effect of the Invention]As explained above, this invention does not support the end face of a screw shaft movably by an elasticity thrust-block means, Since it has the feature at the place which supports movably the pars basilaris ossis occipitalis of the cylinder-like-object-with-base object of PM form inner rotor which a screw shaft fits in by an elasticity thrust-block means, the following effects are done so.

[0038]\*\* Since it is not necessary to form a ball receiver hole in the end face of the screw shaft itself by cutting, low cost-ization is realizable. Since the screw shaft of a narrow diameter unsuitable for cutting can also be used, it contributes to the miniaturization of a motor.

[0039]\*\* In a thrust-block means, since an alignment ball does not move to PM form rotor magnet when the solid angle of the ball receiver hole by the side of PM form rotor magnet is larger than the solid angle of a ball spot hole, it is hard to produce wear of a magnet. If PM form rotor magnet uses a plastic magnet especially, a coefficient of friction will become large and it will become difficult to slide on the part, an alignment ball, and PM form rotor magnet. If the ball spot-hole side is fabricated with a slippage plastic, an alignment ball will not move to PM form rotor magnet still more.

[0040]\*\* It has a penetrated part which opens a ball receiver hole and the tubiform hole inside for free passage to shaft orientations, and case, this penetrated part can be used as a feed hole (grease \*\*\*\*\*). Since an alignment ball adheres to the grease in a penetrated part, it becomes still more difficult to move an alignment ball to PM form rotor magnet.

[0041]\*\* According to the composition which a screw shaft penetrates into the end of a motor body loosely by a loose penetration crevice, and has a motor attaching part by which a fitting position arrangement is carried out in the attaching hole

of the 1st base material outside the plane. To the peripheral surface of a screw shaft, since a motor attaching part is non-contact, it can reduce sliding loss, and it contributes to improvement in output torque. It does not interfere, even if not only when only the other end side portion which can be projected out of a motor body among screw shafts is an external thread part, but a shaft overall length is an external thread part. Since it becomes possible to use the form-rolling screw shaft which cut form-rolling screw bar material to \*\*\*\*\* in this case, cutting screw processing can be eliminated and it can realize to large low cost-ization.

[0042]\*\* Since the length of the external thread part which projects by changing the depth which presses a screw shaft fit in PM form rotor magnet especially is changeable, low cost-ization is also realizable by the common use of a screw shaft.

[0043]\*\* When integral moulding of the motor attaching part is simultaneously carried out by the mold resin material unified by insert molding between yokes and it changes, it contributes to reduction of part mark and much more low cost-ization can be realized.

[0044]\*\* When the crown object which the surface-of-a-sphere journal part which should constitute the bearing surface outside the plane and pivot bearing of the 2nd base material projected in one in the tip part of the screw shaft is attached, As well as the ability to eliminate cutting of the ball receiver hole by the side of the tip of a screw shaft, it contributes to reduction of part mark and low cost-ization can be realized.

[0045]\*\* When it is fabricated with slippage plastic material and changes, contribute this crown object to the reducing friction of a surface-of-a-sphere journal part.

[0046]\*\* When the ball spot hole of a ball presser foot is a ring plate with which a tip part has in one two or more letter plate spring pieces of radiation welded by pressure, respectively towards a center by abbreviation regular intervals in the circumference of a central area of an opposite side as an elastic energization means, Since it is adding to the circumference of a central area of the ball presser foot by the energizing force in which two or more letter plate spring pieces of radiation carried out equivalent and-izing of the posture of a ball presser foot itself can be carried

out [ \*\* 1 ] with an axis, highly precise axial center maintenance is realizable.

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## TECHNICAL FIELD

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[Field of the Invention]This invention relates to the motor for screw delivery whose shaft is a screw shaft especially about the motor for screw delivery used for the zoom mechanism of head seek mechanisms, such as a floppy disk drive, a still camera, and a video camera, etc.

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## PRIOR ART

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[Description of the Prior Art]Conventionally the small stepping motor for screw delivery used for the head seek mechanism of a floppy disk drive, As shown in drawing 5, fit-in immobilization of the one end side is carried out at the tubiform hole of the PM form (permanent magnet form) inner rotor 1, and the screw shaft 2 which used as the external thread part 2a the other end side portion which projects out of a motor body is provided. The tapered shape ball receiver hole 2c is formed in the end surface of this screw shaft 2 for tapered shape ball receiver hole 2b again also at the apical surface of the external thread part 2a. The flat spring 4 which always carries out suppression energization of the steel ball 3 stored in this ball receiver hole 2b from the one end side of the screw shaft 2 to the other end side is formed in the bottom of the cup shape outer yoke 5 of a case and. It has prevented with the backlash of the shaft orientations of the screw shaft 2 (backlash of a screw). The steel ball 3 is used here in order to reduce the sliding loss by the flat spring 4. The lid-like outer yoke 7 which plugs up the opening of the cup shape outer yoke 5 is inserted in the bearing metal 6 which slides on it and carries out the receptacle of the halfway peripheral surface of the screw shaft 2. The motor body side inserts the bearing metal 6 in the attaching hole of the raised piece 20a of the frame of a floppy disk drive, and screws the flange 5a of the cup shape outer yoke 5 on. The external thread part 2a side shows the ball receiver hole 2c to

spite the steel ball 23 of the bearing 21 which was cut and was inserted in the attaching hole of the piece 20b of a lifting. Both-way \*\*\*\*\* of the head carriage 22 with the internal thread part 22a screwed in it by rotation of the screw shaft 2 is carried out in shaft orientations.

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## EFFECT OF THE INVENTION

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[Effect of the Invention]As explained above, this invention does not support the end face of a screw shaft movably by an elasticity thrust-block means, Since it has the feature at the place which supports movably the pars basilaris ossis occipitalis of the cylinder-like-object-with-base object of PM form inner rotor which a screw shaft fits in by an elasticity thrust-block means, the following effects are done so.

[0038]\*\* Since it is not necessary to form a ball receiver hole in the end face of the screw shaft itself by cutting, low cost-ization is realizable. Since the screw shaft of a narrow diameter unsuitable for cutting can also be used, it contributes to the miniaturization of a motor.

[0039]\*\* In a thrust-block means, since an alignment ball does not move to PM form rotor magnet when the solid angle of the ball receiver hole by the side of PM form rotor magnet is larger than the solid angle of a ball spot hole, it is hard to produce wear of a magnet. If PM form rotor magnet uses a plastic magnet especially, a coefficient of friction will become large and it will become difficult to slide on the part, an alignment ball, and PM form rotor magnet. If the ball spot-hole side is fabricated with a slippage plastic, an alignment ball will not move to PM form rotor magnet still more.

[0040]\*\* It has a penetrated part which opens a ball receiver hole and the tubiform hole inside for free passage to shaft orientations, and case, this penetrated part can be used as a feed hole (grease \*\*\*\*\*). Since an alignment ball adheres to the grease in a penetrated part, it becomes still more difficult to move an alignment ball to PM form rotor magnet.

[0041]\*\* According to the composition which a screw shaft



penetrates into the end of a motor body loosely by a loose penetration crevice, and has a motor attaching part by which a fitting position arrangement is carried out in the attaching hole of the 1st base material outside the plane. To the peripheral surface of a screw shaft, since a motor attaching part is non-contact, it can reduce sliding loss, and it contributes to improvement in output torque. It does not interfere, even if not only when only the other end side portion which can be projected out of a motor body among screw shafts is an external thread part, but a shaft overall length is an external thread part. Since it becomes possible to use the form-rolling screw shaft which cut form-rolling screw bar material to \*\*\*\*\* in this case, cutting screw processing can be eliminated and it can realize to large low cost-ization.

[0042]\*\* Since the length of the external thread part which projects by changing the depth which presses a screw shaft fit in PM form rotor magnet especially is changeable, low cost-ization is also realizable by the common use of a screw shaft.

[0043]\*\* When integral moulding of the motor attaching part is simultaneously carried out by the mold resin material unified by insert molding between yokes and it changes, it contributes to reduction of part mark and much more low cost-ization can be realized.

[0044]\*\* When the crown object which the surface-of-a-sphere journal part which should constitute the bearing surface outside the plane and pivot bearing of the 2nd base material projected in one in the tip part of the screw shaft is attached, As well as the ability to eliminate cutting of the ball receiver hole by the side of the tip of a screw shaft, it contributes to reduction of part mark and low cost-ization can be realized.

[0045]\*\* When it is fabricated with slippage plastic material and changes, contribute this crown object to the reducing friction of a surface-of-a-sphere journal part.

[0046]\*\* When the ball spot hole of a ball presser foot is a ring plate with which a tip part has in one two or more letter plate spring pieces of radiation welded by pressure, respectively towards a center by abbreviation regular intervals in the circumference of a central area of an opposite side as an elastic energization means, Since it is adding to the circumference of a central area of the

ball presser foot by the energizing force in which two or more letter plate spring pieces of radiation carried out equivalent and-izing of the posture of a ball presser foot itself can be carried out [ \*\* 1 ] with an axis, highly precise axial center maintenance is realizable.

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#### TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention]However, if it was in the above-mentioned motor for screw delivery, there were the following problems.

[0004]\*\* Although ball receiver hole 2b and 2c needed to be formed in the both-ends side of the screw shaft 2 used for the motor for screw delivery, since such ball receiver hole 2bs and 2c were formed by cutting, they had become about the obstacle of formation of a narrow diameter shaft, or low-cost-izing.

[0005]\*\* Since axial center maintenance of the screw shaft 2 was performed using the plain-bearing metal 6, the sliding loss by the metal 6 arose and it had become a factor of torque loss again.

[0006]Then, in view of the above-mentioned problem, there is the 1st technical problem of this invention in providing the motor for screw delivery which it is possible to use the screw shaft of a narrow diameter, and can realize low cost-ization.

[0007]There is the 2nd technical problem of this invention in providing the motor for screw delivery which axial center maintenance of a screw shaft is possible, and can realize reduction of sliding loss without using radial sliding bearing.

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#### MEANS

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[Means for Solving the Problem]In a motor for screw delivery provided with a screw shaft which has an external thread part in an other end side portion which carries out fit-in immobilization of the one end side at a tubiform hole of PM form inner rotor, and can be projected out of a motor body at least since the 1st technical

problem of the above is solved, The above-mentioned PM form inner rotor has an elasticity thrust-block means which is a cylinder-like-object-with-base-like object, carries out alignment regulation of the center of rotation of the external bottom, and carries out elastic energization of the above-mentioned PM form inner rotor to shaft orientations.

[0009]Since the tip side of a screw shaft is what is supported by a thrust block from the first in the case of attachment of a motor for screw delivery, Like this invention, axial center maintenance is possible at the end face side of a screw shaft, i.e., structure which carries out thrust support of the cylinder-like-object-with-base-like object of PM form rotor magnet by an elasticity thrust-block means. A end face of a screw shaft is not supported movably by an elasticity thrust-block means like before, Since it is the structure which supports movably a pars basilaris ossis occipitalis of a cylinder-like-object-with-base-like object of PM form rotor magnet, it is not necessary to form a ball receiver hole in the end face of the screw shaft itself by cutting, and structure of a ball receiver hole for alignment regulation, etc. can be provided in a pars basilaris ossis occipitalis of a cylinder-like-object-with-base-like object thicker than a path of a screw shaft. A part and low-cost-izing which can eliminate cutting by the side of a end face of a shaft are realizable.

[0010]Since a screw shaft of a narrow diameter unsuitable for cutting can also be used, it contributes to a miniaturization of a motor.

[0011]It has a thrust-block means which applies an alignment ball in the center by the side of the above-mentioned external bottom, and carries out thrust support of the PM form inner rotor as this elasticity thrust-block means, and an elastic energization means which always carries out elastic energization of the PM form inner rotor to shaft orientations via this thrust-block means.

[0012]And this thrust-block means has a ball receiver hole of approximately tapered shape formed in the center of an external bottom, an alignment ball stored in this ball receiver hole, and the ball presser foot which possesses a ball spot hole of approximately tapered shape of a \*\*\*\*\* sake for an alignment ball to shaft orientations. A function to hold an axial center of PM form rotor magnet, i.e., a screw shaft, (alignment regulation) is

exhibited.

[0013]In the above-mentioned thrust-block means, it is preferred here that a solid angle of a ball receiver hole by the side of PM form rotor magnet is larger than a solid angle of a ball spot hole. Since the osculating circle of an alignment ball and a ball receiver hole is larger than an osculating circle of an alignment ball and a ball spot hole, when a coefficient of friction is generally made equivalent in this case, an alignment ball is immobilization to a ball receiver hole, and an alignment ball will slide on it and turn around a ball spot-hole top. Since an alignment ball does not move to PM form rotor magnet, it is hard to produce wear of a magnet. If PM form rotor magnet uses a plastic magnet especially, a coefficient of friction will become large and it will become difficult to slide on the part, an alignment ball, and PM form rotor magnet. If the ball spot-hole side is fabricated with a slippage plastic, an alignment ball will not move to PM form rotor magnet still more.

[0014]Having a penetrated part which opens a ball receiver hole and the tubiform hole inside for free passage to shaft orientations has [ PM form rotor magnet ] preferred things. This penetrated part can be used as a feed hole (grease \*\*\*\*\*). Since an alignment ball adheres to grease in a penetrated part, it becomes still more difficult to move an alignment ball to PM form rotor magnet.

[0015]Next, in order to solve the 2nd technical problem of the above, in the above-mentioned composition at in addition, the end of the above-mentioned motor body. A screw shaft penetrates loosely by a loose penetration crevice, and according to composition which has a motor attaching part by which a fitting position arrangement is carried out in an attaching hole of the 1st base material outside the plane, since a motor attaching part is non-contact, it can reduce sliding loss to a peripheral surface of a screw shaft, and contributes to improvement in output torque at it. And even if not only when only an other end side portion which can be projected out of a motor body among screw shafts is an external thread part, but a shaft overall length is an external thread part, it does not interfere again. Since it becomes possible to use a form-rolling screw shaft which cut form-rolling screw bar material to \*\*\*\*\* in this case, cutting screw processing can be eliminated and large low cost-ization can be realized. Since the length of an external

thread part which projects by changing the depth which presses a screw shaft fit in PM form rotor magnet especially is changeable, low cost-ization is also realizable by common use of a screw shaft. [0016]Since the tip side of a screw shaft is what is supported by a thrust block in the case of attachment of a motor for screw delivery as mentioned above, axial center maintenance is possible also with structure which carries out thrust support of the cylinder-like-object-with-base-like object of PM form rotor magnet by an elasticity thrust-block means.

[0017]If integral moulding of the above-mentioned motor attaching part is simultaneously carried out here by mold resin material unified by insert molding between yokes and it grows into it, it contributes to reduction of part mark and much more low cost-ization can be realized.

[0018]Attaching a crown object which a surface-of-a-sphere journal part which should constitute the bearing surface outside the plane and pivot bearing of the 2nd base material projected in one to a tip part by the side of the other end of the above-mentioned screw shaft has preferred things. As well as the ability to eliminate cutting of a ball receiver hole by the side of the other end of a screw shaft, since the covering object itself possesses a surface-of-a-sphere journal part in one, it contributes to reduction of part mark and low cost-ization can be realized.

[0019]As for this crown object, it is preferred for it to be fabricated with slippage plastic material and to change. It contributes to reducing friction of a surface-of-a-sphere journal part.

[0020]As the above-mentioned elastic energization means, a ball spot hole of a ball presser foot is a ring plate with which a tip part has in one two or more letter plate spring pieces of radiation welded by pressure, respectively towards a center by abbreviation regular intervals in the circumference of a central area of an opposite side. Since it is adding to the circumference of a central area of a ball presser foot by energizing force in which two or more letter plate spring pieces of radiation carried out equivalent and-izing of the posture of a ball presser foot itself can be carried out [ \*\* 1 ] with an axis, highly precise axial center maintenance is realizable.

[0021]And it has a follower member screws in a motor for screw

delivery which was mentioned above, and its screw shaft, and screw delivery is carried out to shaft orientations by the rotation of, and is suitable for using a screw delivery mechanism for electrically powered equipments, such as a floppy disk drive, a still camera, and a video camera.

[0022]

[Embodiment of the Invention]Next, each embodiment of this invention is described based on an accompanying drawing.

[0023][Embodiment 1] Drawing 1 is a vertical section side view showing the screw delivery mechanism using the motor for screw delivery concerning Embodiment 1 of this invention. The portion and identical parts which are shown in drawing 5 attach the same reference mark, and omit the explanation.

[0024]The motor for screw delivery of this example (small stepping motor) presses the end face side fit in the tubiform hole 30a of the PM form inner rotor 30, and has the screw shaft 31 which has the external thread part 31a in an overall length. This screw shaft 31 is a form-rolling screw shaft which cut and used form-rolling screw bar material for \*\*\*\*\*. The PM form inner rotors 30 are plastic magnet mold goods, such as NEOJI or samarium iron Chisso, and serve as a cylinder-like-object-with-base-like object. And it has with the thrust-block mechanism 40 which carries out alignment regulation of the outside center of rotation of the pars basilaris ossis occipitalis 30b of a cylinder-like-object-with-base-like object, and the elastic energization means slack ring plate 50 which always carries out elastic energization of the PM form inner rotor 30 to shaft orientations (the direction of a tip of the screw shaft 31) via this thrust-block mechanism 40.

[0025]The ball receiver hole 30c of approximately tapered shape which the thrust-block mechanism 40 applied the alignment ball (steel ball) 3 in the center of the outside surface side of the pars basilaris ossis occipitalis 30b, and carries out thrust bearing and formed the PM form inner rotor 30 in the central area of the outside surface of the pars basilaris ossis occipitalis 30b, It has the alignment ball 3 stored in this ball receiver hole 30c, and the ball presser foot 32 which possesses the ball spot hole 32a of approximately tapered shape of a \*\*\*\*\* sake for that alignment ball 3 to shaft orientations.

[0026]Here, the solid angle (about 120 \*\*) of the ball receiver

hole 30c of the PM form inner rotor 30 is larger than the solid angle (about 60 degrees) of the ball spot hole 32a of the ball presser foot 32. In the PM form inner rotor 30, the penetrated part 30d which opens the ball receiver hole 30c and the tubiform hole 30a inside for free passage to shaft orientations is formed. This penetrated part 30d is used as grease \*\*\*\*\*. The ball presser feet 32 are mold goods of slippage plastic material.

[0027]The ball presser foot 32 is an integrally molded product of the fitting part 32b inserted in the tubiform hole of the diaphragm tubed part 5a which projects on the bottom of the cup shape outer yoke 5 of a case and so that shaft-orientations idle movement is possible, and the collar-like part 32c which carries out a slip off stop. As shown in drawing 2 (A) and drawing 3, 32 d of location notches corresponding to two or more letter plate spring pieces 50a of radiation of the ring plate 50 are formed in the fitting part 32b. The ring plate 50 is positioned by \*\*\*\* (clo pole) 5b of five poles started inside from the bottom of the cup shape outer yoke 5, It has in one [ centering on two or more letter plate spring pieces 50a of radiation which fit into 32 d of location notches, and a tip part welds by pressure to the circumference of a central area of the collar-like part 32c by abbreviation regular intervals, respectively ].

[0028]The outer stator of a motor body is provided with the following.

The lid-like outer yoke 7 which has \*\*\*\* (clo pole) 7a of five poles started inside as the opening of the \*\* cup shape outer yoke 5 is shown in \*\*\*\* and drawing 2 (B) outside the above-mentioned cup shape outer yoke 5.

The crown-like 1st inner yoke 8 in which \*\*\*\* 8a is positioned between the \*\*\*\* 5b within the cup shape outer yoke 5

The crown-like 2nd inner yoke 9 in which \*\*\*\* 9a is positioned between \*\*\*\* 7a of the lid-like outer yoke 7 within the cup shape outer yoke 5

The coil coil 11 which constitutes an A phase, and the coil coil 12 which constitutes a B phase.

The 1st inner yoke 8 and 2nd inner yoke 9 are unified with the mold resin 13 by insert molding, and the mold resin 13 is also making the insulating layer serve a double purpose. At the time of insert molding, the terminal block 14 and the motor attaching part 60 are

simultaneously formed with the mold resin 13. The terminal pin 14a stands erect in the terminal block 14.

[0029]In the end of a motor body, the screw shaft 31 penetrates loosely by the loose penetration crevice 60a, and the fitting position arrangement of the motor attaching part 60 made of this resin is carried out in the attaching hole of the raised piece 20a of a frame. The motor attaching part 60 has the locating lug 60b which fits in between \*\*\*\* 7a of the lid-like outer yoke 7.

[0030]Since thrust support of the tip side of the screw shaft 31 is carried out by the ball receiver hole 2c, the steel ball 23, and the bearing 21 when using the motor for screw delivery of such composition for the screw delivery mechanism shown in drawing 1, like this example, only the thrust-block mechanism 40 is provided in the end face side, and the conventional metal bearing 6 is not provided. Reduction of part mark can be aimed at. In this example, since it is not necessary to form a ball receiver hole in the end face side of screw shaft 31 the very thing by cutting and, and it is the structure which supports movably the pars basilaris ossis occipitalis 30b of the cylinder-like-object-with-base-like object of the PM form rotor magnet 30 and a cheap form-rolling screw shaft can be used, low cost-ization is realizable. The direction which forms the ball receiver hole 30c for alignment regulation in the pars basilaris ossis occipitalis 30b of a cylinder-like-object-with-base-like object thicker than the path of the screw shaft 31 by resin molding can carry out [ cheap ]-izing of the manufacturing cost. It contributes to the miniaturization of a motor.

[0031]Since the solid angle of the ball receiver hole 30c by the side of the PM form rotor magnet 30 has size-come to come rather than the solid angle of the ball spot hole 32a of the ball presser foot 32, and the osculating circle by the side of the ball receiver hole 30c is larger than the osculating circle of the ball spot hole 32a, a slide is produced between the alignment ball 3 and the ball spot hole 32a. Therefore, since the alignment ball 3 does not move to the PM form rotor magnet 30, it is hard to produce wear of the magnet 30. In particular, since the PM form rotor magnets 30 are plastic magnets, such as NEOJI, a coefficient of friction becomes large, and it becomes difficult to slide on the part, the alignment ball 3, and the PM form rotor magnet 30, and is convenient. In addition, since the ball presser foot 32 is a slippage plastic,



between the PM form rotor magnet 30 and the alignment ball 3, it is still more hard to produce sliding. And since the penetrated part 30d is used as a feed hole (grease \*\*\*\*\*), it adheres to the alignment ball 3 at grease, and to the peripheral surface of the screw shaft 31, since the motor attaching part 60 is non-contact, it can reduce sliding loss, and contributes to improvement in output torque again. Since it is non-contact, the form-rolling screw shaft 31 whose shaft overall length is an external thread part about the screw shaft 31 can be used, and much more low cost-ization can be realized. Since the length of the external thread part 31a which projects by changing the depth which presses the screw shaft 31 fit in the PM form rotor magnet 30 especially is changeable, The screw shaft 31 can be shared to the screw feed motor with which the length of the external thread part 31a differs, and low cost-ization can also be realized.

[0032]Integral moulding of this motor attaching part 60 is simultaneously carried out by the yoke 8 unified by insert molding, and the mold resin material between nine, and it changes. Therefore, it contributes to reduction of part mark etc. and much more low cost-ization can be realized. The lid-like outer yoke 7 may also be simultaneously unified by the above-mentioned insert molding. It contributes to reduction of an attachment man day.

[0033]The tip part has the ring plate 50 in one [ centering on two or more letter plate spring pieces 50a of radiation welded by pressure, respectively ] by abbreviation regular intervals around [ central area ] the opposite side of the collar-like part 32c of the ball presser foot 32. Since it is adding to the circumference of a central area of the ball presser foot 32 by the energizing force in which two or more letter plate spring pieces 50a of radiation carried out equivalent and-izing of the posture of the ball presser foot 32 itself can be carried out [ \*\* 1 ] with an axis, highly precise axial center maintenance is realizable.

[0034][Embodiment 2] Drawing 4 is a vertical section side view showing the screw delivery mechanism using the motor for screw delivery concerning Embodiment 2 of this invention. The portion and identical parts which are shown in drawing 1 attach the same reference mark, and omit the explanation.

[0035]It is in the place which attaches the crown object 70 which the surface-of-a-sphere journal part 71 which should constitute the

bearing 23 which was cut to the tip part of the screw shaft 31, and was inserted in it as a feature of this example in the attaching hole of the piece 20b of a lifting, and pivot bearing projected in one. This crown object 70 is mold goods of slippage plastic material. Since cutting by the side of the tip of the screw shaft 31 can also be eliminated and it will become unnecessary [ the steel ball 23 ] if such a crown object 70 is used, much more low cost-ization is realizable. Since slippage plastic material is used, it contributes to reducing friction. The operation effect of others of this example is the same as that of Embodiment 1.

[0036]The screw delivery mechanism using a motor for screw delivery which was mentioned above is suitable for using for electrically powered equipments, such as a floppy disk drive, a still camera, and a video camera.

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#### DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1]It is a vertical section side view showing the screw delivery mechanism using the motor for screw delivery concerning Embodiment 1 of this invention.

[Drawing 2]The rear elevation in which (A) shows the motor for the said screw delivery, and (B) are the top views showing the motor for the said screw delivery.

[Drawing 3]It is a cut plane side which shows the relation of the ring plate and ball presser foot in the motor for the said screw delivery.

[Drawing 4]It is a vertical section side view showing the screw delivery mechanism using the motor for screw delivery concerning Embodiment 2 of this invention.

[Drawing 5]It is a vertical section side view showing the screw delivery mechanism using the conventional motor for screw delivery.

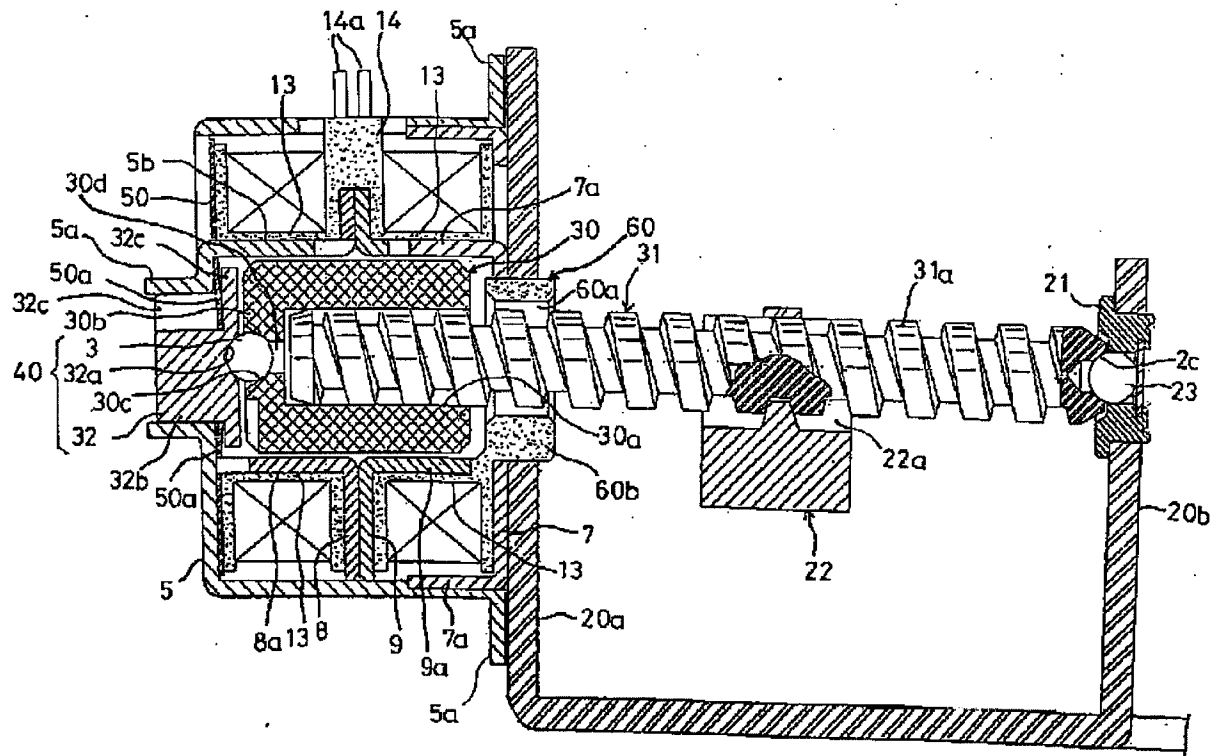
[Description of Notations]

- 1, 30 -- PM form (permanent magnet form) inner rotor
- 2, 31 -- Screw shaft
- 2a, 31a -- External thread part
- 2b, 2c, 30c -- Ball receiver hole
- 3, 23 -- Steel ball (alignment ball)

4 -- Flat spring  
5 -- Cup shape outer yoke 5  
5b, 7a, 8a, 9b -- \*\*\*\* (clo pole)  
6 -- Bearing metal  
7 -- Lid-like outer yoke  
8 -- The 1st inner yoke  
9 -- The 2nd inner yoke  
11, 12 -- Coil coil  
13 -- Mold resin  
14 -- Terminal block  
14a -- Terminal pin  
20a -- Raised piece of a frame  
20b -- Piece of a lifting  
22 -- Head carriage  
22a -- Internal thread part  
30a -- Tubiform hole  
30b -- Pars basilaris ossis occipitalis  
30d -- Penetrated part  
32 -- Ball presser foot  
32a -- Ball spot hole  
32b -- Fitting part  
32c -- Collar-like part  
32d -- Location notch  
40 -- Thrust-block mechanism  
50 -- Ring plate  
50a -- Letter plate spring piece of radiation  
60 -- Motor attaching part  
60a -- Loose penetration crevice  
60b -- Locating lug  
70 -- Crown object  
71 -- Surface-of-a-sphere journal part.

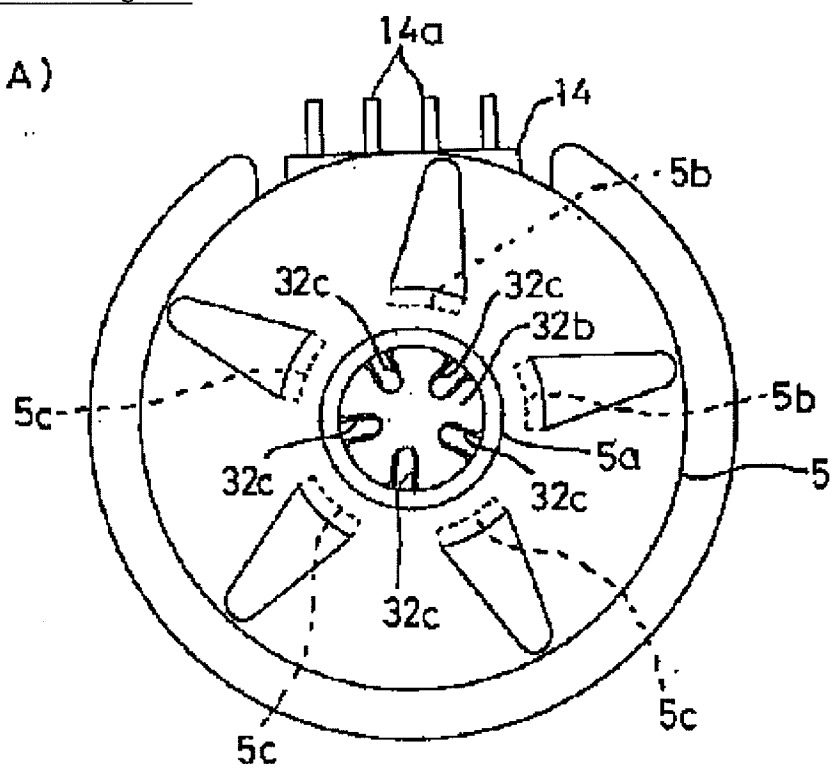
## DRAWINGS

[Drawing 1]

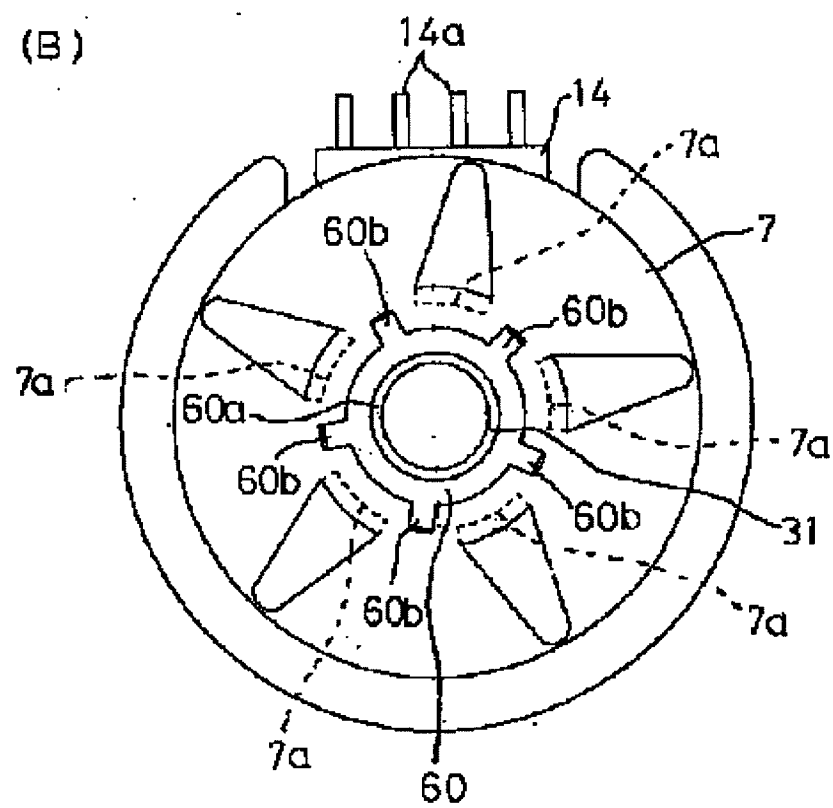


[Drawing 2]

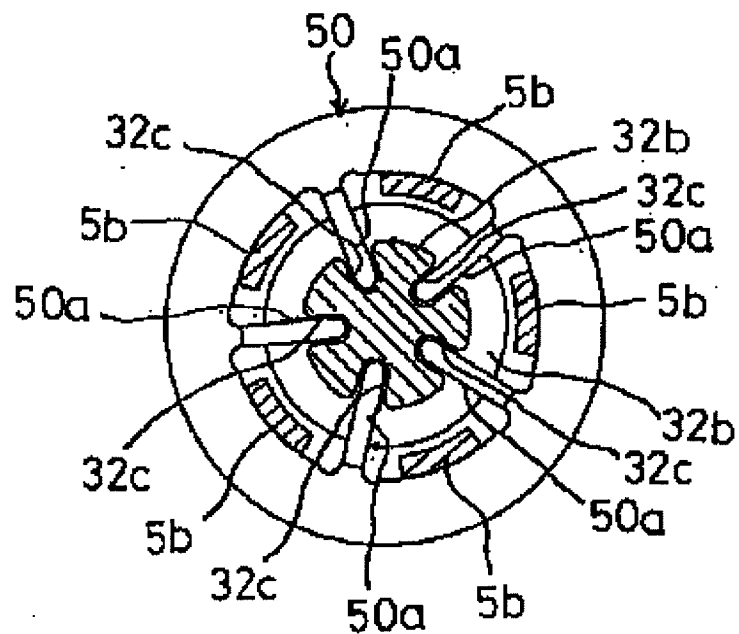
(A)



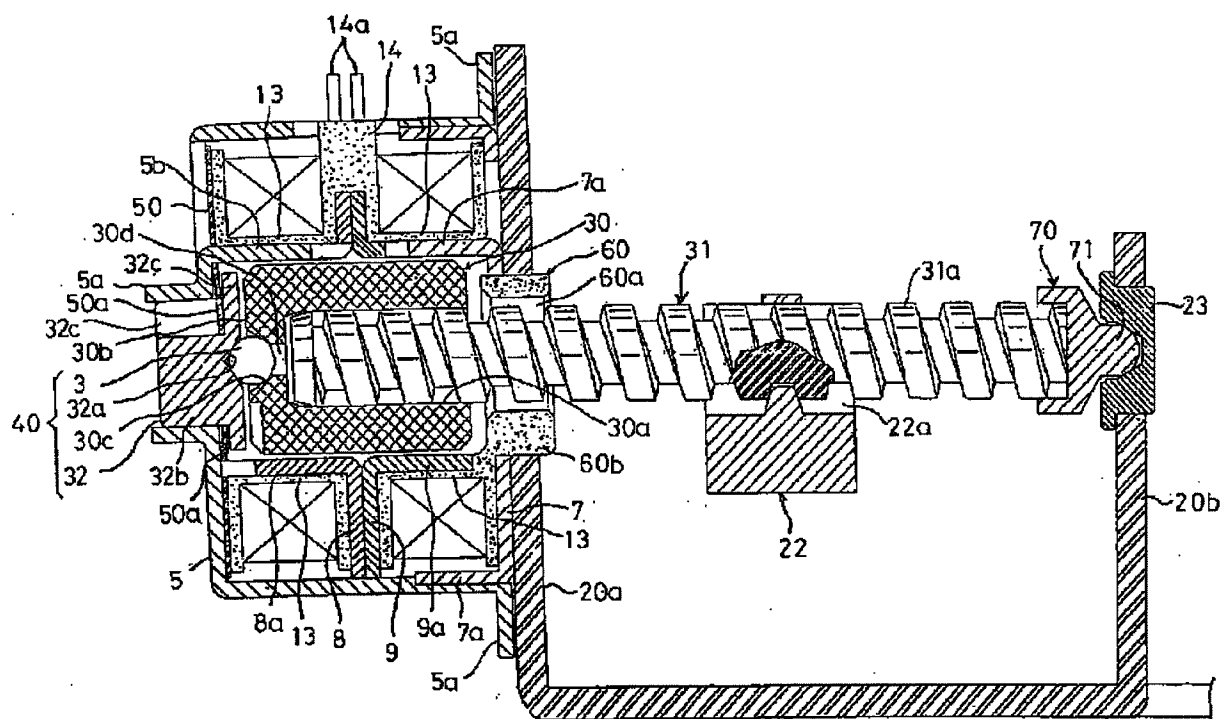
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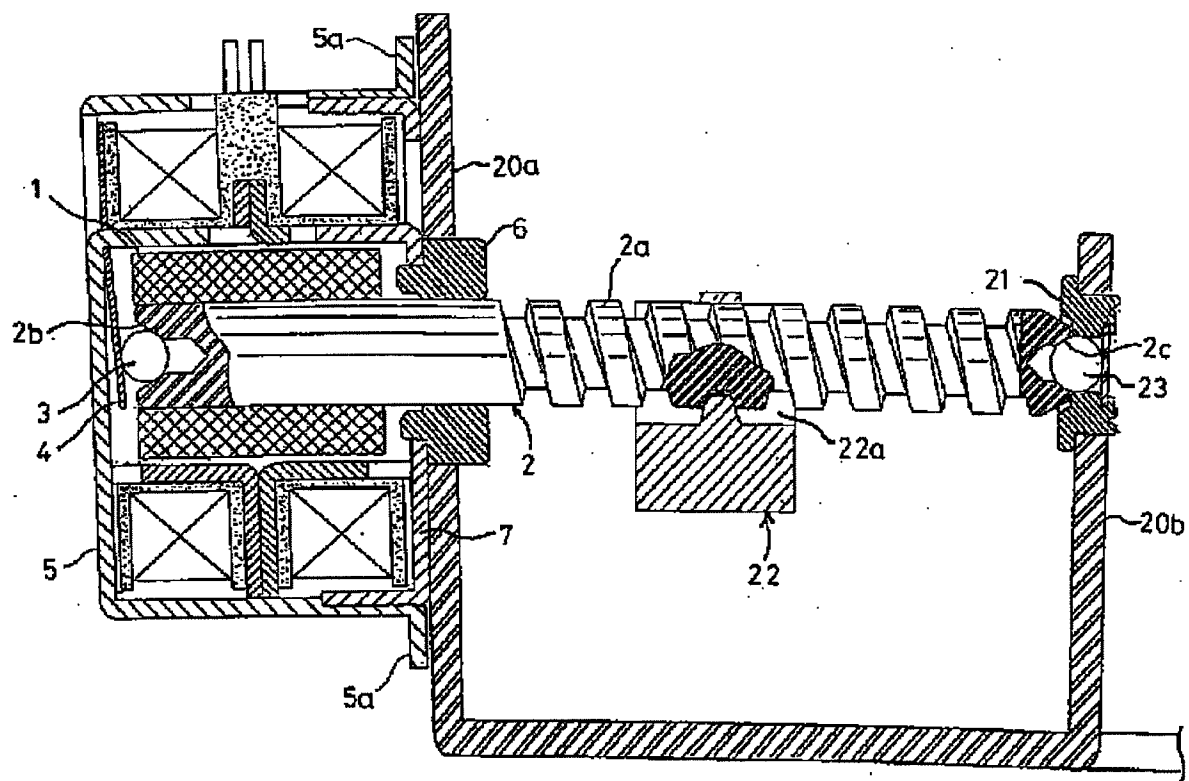
[Drawing 3]



[Drawing 4]



[Drawing 5]



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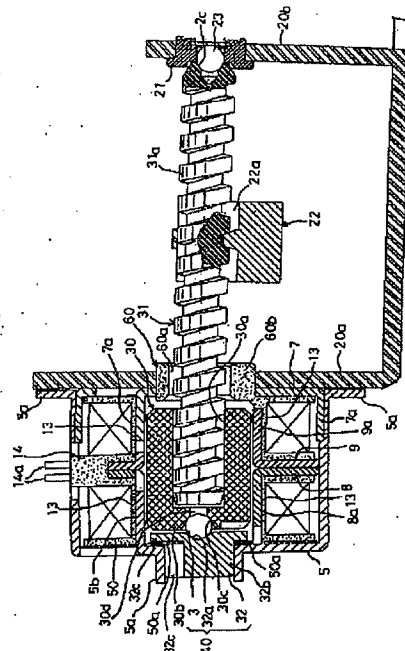
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## (54) 【発明の名称】 螺子送り用モータ

## (57) 【要約】

【課題】 細径のスクリーシャフトを用いることが可能であって、低コスト化を実現できる螺子送り用モータの提供。

【解決手段】 螺子送り用モータはPM形インナーロータ30の筒孔30aに基端側を圧入し、全長に雄螺子部31aを持つスクリーシャフト31を有し、シャフト31は転造螺子棒材を所定寸に切断して用いた転造スクリーシャフトである。PM形インナーロータ30は有底筒状体であり、その底部30bの外周回転中心を調心規制するスラスト軸受機構40と、このスラスト軸受機構40を介してPM形インナーロータ30を軸方向に常時弾力付勢するリング板50と有している。スクリーシャフト自体の端面に切削加工により玉受穴を形成する必要がないので、低コスト化を実現できる。また切削加工に不向きな細径のスクリーシャフトを用いることもできるため、モータの小形化に寄与する。





【特許請求の範囲】

【請求項１】 ＰＭ形インナーロータの筒孔に一端側を挿嵌固定し、少なくともモータ本体外へ突出せる他端側部分に雄螺子部を持つスクリュシャフトを備える螺子送り用モータにおいて、

前記ＰＭ形インナーロータは有底筒状体であって、その底部外面の回転中心を調心規制して前記ＰＭ形インナーロータを軸方向に弾力付勢する弾力スラスト軸受手段を有して成ることを特徴とする螺子送り用モータ。

【請求項２】 請求項１において、前記弾力スラスト軸受手段は、前記底部外面側の中央に調心玉を当てて前記ＰＭ形インナーロータをスラスト支持するスラスト軸受手段と、このスラスト軸受手段を介して前記ＰＭ形インナーロータを前記軸方向に常時弾力付勢する弾力付勢手段と、を有して成ることを特徴とする螺子送り用モータ。

【請求項３】 請求項２において、前記スラスト軸受手段は、前記底部外面の中心に形成した略テーパ状の玉受穴と、この玉受穴に収めた前記調心玉と、前記調心玉を軸方向へ押圧するための略テーパ状の玉押し穴を具備する玉押しとを有して成ることを特徴とする螺子送り用モータ。

【請求項４】 請求項３において、前記玉受穴の立体角が前記玉押し穴の立体角よりも大きいことを特徴とする螺子送り用モータ。

【請求項５】 請求項３又は請求項４において、前記ＰＭ形インナーロータは、前記玉受穴と前記筒孔内側とを軸方向に連通する貫通部を有して成ることを特徴とする螺子送り用モータ。

【請求項６】 請求項１乃至請求項５のいずれか一項において、前記モータ本体の端部に、前記スクリュシャフトが遊貫隙間を以て遊貫し、機外の第１支持体の取付穴に嵌合位置決めされるモータ保持部を有して成ることを特徴とする螺子送り用モータ。

【請求項７】 請求項６において、前記モータ保持部は、インサート成形で一体化したヨーク相互のモールド樹脂材を以て同時に一体成形されて成ることを特徴とする螺子送り用モータ。

【請求項８】 請求項６又は請求項７のいずれか一項において、前記スクリュシャフトは転造螺子棒材を所定寸に切断して用いた転造スクリュシャフトであることを特徴とする螺子送り用モータ。

【請求項９】 請求項１乃至請求項８のいずれか一項において、前記スクリュシャフトの前記他端側の先端部には、機外の第２支持体の軸受面とピボット軸受を構成すべき球面ジャーナル部が一体的に突出した冠体を嵌着して成ることを特徴とする螺子送り用モータ。

【請求項１０】 請求項１乃至請求項９のいずれか一項において、前記ＰＭ形インナーロータはプラスチックマグネット成形品であることを特徴とする螺子送り用モータ。

タ。

【請求項１１】 請求項３乃至請求項１０のいずれか一項において、前記玉押しは滑性プラスチック材質で成形されて成ることを特徴とする螺子送り用モータ。

【請求項１２】 請求項９乃至請求項１１のいずれか一項において、前記冠体は滑性プラスチック材質で成形されて成ることを特徴とする螺子送り用モータ。

【請求項１３】 請求項３乃至請求項１２のいずれか一項において、前記弾力付勢手段は、前記玉押えの前記玉押し穴とは反対面の中心域周囲に略等間隔で先端部がそれぞれ圧接する複数の輻射状板バネ片を中心にに向けて一体的に持つリング板であることを特徴とする螺子送り用モータ。

【請求項１４】 請求項１乃至請求項１３のいずれか一項に規定する螺子送り用モータと、前記スクリュシャフトに螺合してその回転により軸方向に螺子送りされる従動部材とを有する螺子送り機構を備えて成ることを特徴とする電動機器。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、フロッピーディスクドライブ等のヘッド・シーク機構、スチルカメラ及びビデオカメラのズーム機構等に用いる螺子送り用モータに関し、特に、モータシャフトがスクリュシャフトである螺子送り用モータに関する。

【０００２】

【従来の技術】従来、フロッピーディスクドライブのヘッド・シーク機構に用いる螺子送り用小形ステッピングモータは、図５に示す如く、ＰＭ形（永久磁石形）インナーロータ１の筒孔に一端側を挿嵌固定し、モータ本体外へ突出する他端側部分を雄螺子部２ａとしたスクリュシャフト２を具備している。このスクリュシャフト２の一端面にはテーパ状の玉受穴２ｂが、また雄螺子部２ａの先端面にもテーパ状の玉受穴２ｃが形成されている。この玉受穴２ｂに収めた鋼球３をスクリュシャフト２の一端側から他端側へ常時弾圧付勢する板バネ４がケース兼のカップ状アウターヨーク５の底面に設けられている。スクリュシャフト２の軸方向のガタ付き（螺子のバックラッシュ）を防止している。ここに、鋼球３を用いるのは、板バネ４による摺動損を軽減するためである。スクリュシャフト２の中途周面を滑り受けする軸受メタル６にはカップ状アウターヨーク５の開口を塞ぐ蓋状アウターヨーク７が嵌め合わされている。モータ本体側は軸受メタル６をフロッピーディスクドライブのフレームの起立片２０ａの取付穴に嵌めてカップ状アウターヨーク５のフランジ５ａを螺着する。雄螺子部２ａ側は切り起こし片２０ｂの取付穴に嵌めた軸受２１の鋼球２３に玉受穴２ｃを当て付けて成る。スクリュシャフト２の回転によりそれに螺合する雌螺子部２２ａを持つヘッドキャリッジ２２が軸方向に往復螺子送されるよ

うになっている。

【0003】

【発明が解決しようとする課題】しかしながら、上記の螺子送り用モータにあつては、次のような問題点があつた。

【0004】① 螺子送り用モータに用いるスクリューシャフト2の両端面には玉受穴2b、2cを形成する必要があるが、これらの玉受穴2b、2cは切削加工で形成されているため、細径シャフトの形成や低コスト化の障害をなっていた。

【0005】② また、滑り軸受メタル6を用いてスクリューシャフト2の軸心保持を行っているため、メタル6による摺動損が生じ、トルク損失の要因となっていた。

【0006】そこで、上記問題点に鑑み、本発明の第1の課題は、細径のスクリューシャフトを用いることが可能であつて、低コスト化を実現できる螺子送り用モータを提供することにある。

【0007】本発明の第2の課題は、ラジアル滑り軸受を用いることなく、スクリューシャフトの軸心保持が可能であつて、摺動損失の低減を実現できる螺子送り用モータを提供することにある。

【0008】

【課題を解決するための手段】上記第1の課題を解決するため、PM形インナーロータの筒孔に一端側を挿嵌固定し、少なくともモータ本体外へ突出させる他端側部分に雄螺子部を持つスクリューシャフトを備える螺子送り用モータにおいて、上記PM形インナーロータは有底筒状体であつて、その底部外面の回転中心を調心規制して上記PM形インナーロータを軸方向に弾力付勢する弾力スラスト軸受手段を有して成ることを特徴とする。

【0009】元々、螺子送り用モータの取付の際、スクリューシャフトの先端側がスラスト軸受で支持されるものであるため、本発明のように、スクリューシャフトの基端側、即ち、PM形ロータマグネットの有底筒状体を弾力スラスト軸受手段でスラスト支持する構造でも軸心保持が可能である。従来のように、スクリューシャフトの基端を弾力スラスト軸受手段で支承するのではなく、PM形ロータマグネットの有底筒状体の底部を支承する構造であるため、スクリューシャフト自体の端面に切削加工により玉受穴を形成する必要がなく、スクリューシャフトの径よりも太い有底筒状体の底部に調心規制のための玉受穴などの構造を設けることができる。シャフトの基端側の切削加工を排除できる分、低コスト化を実現できる。

【0010】また、切削加工に不向きな細径のスクリューシャフトを用いることもできるため、モータの小形化に寄与する。

【0011】この弾力スラスト軸受手段としては、上記底部外面側の中央に調心玉を当ててPM形インナーロー

タをスラスト支持するスラスト軸受手段と、このスラスト軸受手段を介してPM形インナーロータを軸方向に常時弾力付勢する弾力付勢手段とを有して成る。

【0012】そして、このスラスト軸受手段は、底部外面の中心に形成した略テーパ状の玉受穴と、この玉受穴に収めた調心玉と、調心玉を軸方向へ押圧するための略テーパ状の玉押し穴を具備する玉押しとを有して成る。PM形ロータマグネット即ちスクリューシャフトの軸心を保持（調心規制）する機能を発揮する。

【0013】ここに、上記のスラスト軸受手段において、PM形ロータマグネット側の玉受穴の立体角が玉押し穴の立体角よりも大きいことが好ましい。かかる場合、調心玉と玉受穴の接触円の方が調心玉と玉押し穴の接触円よりも大きいため、一般に摩擦係数を同等とした場合、調心玉は玉受穴に対して不動であり、調心玉は玉押し穴上を滑り回ることになる。PM形ロータマグネットに対して調心玉が動かないので、マグネットの磨滅が生じ難い。特に、PM形ロータマグネットがプラスチックマグネットを用いると、摩擦係数が大になり、その分、調心玉とPM形ロータマグネットとが摺動し難くなる。また玉押し穴側を滑性プラスチックで成形すれば、尚更、PM形ロータマグネットに対して調心玉が動かない。

【0014】PM形ロータマグネットは、玉受穴と筒孔内側とを軸方向に連通する貫通部を有して成ることが好ましい。この貫通部を給油孔（グリス溜まり）として用いることができる。貫通部内のグリスに調心玉が附着するので、尚更、調心玉がPM形ロータマグネットに対して動き難くなる。

【0015】次に、上記第2の課題を解決するため、上記の構成に加えて、上記モータ本体の端部に、スクリューシャフトが遊貫隙間を以て遊貫し、機外の第1支持体の取付穴に嵌合位置決めされるモータ保持部を有して成る構成によれば、モータ保持部はスクリューシャフトの周面に非接触であるため、摺動損失を低減でき、出力トルクの向上に寄与する。そしてまた、スクリューシャフトのうちモータ本体外へ突出させる他端側部分のみが雄螺子部である場合に限らず、シャフト全長が雄螺子部であっても差支えない。かかる場合、転造螺子棒材を所定寸に切断した転造スクリューシャフトを用いることが可能となるため、切削螺子加工を排除することができ、大幅な低コスト化を実現できる。特に、スクリューシャフトをPM形ロータマグネットに圧入する深さを変えることにより突出する雄螺子部の長さを変えることができるため、スクリューシャフトの共用化により低コスト化も実現できる。

【0016】なお、前述したように、螺子送り用モータの取付の際、スクリューシャフトの先端側がスラスト軸受で支持されるものであるため、PM形ロータマグネットの有底筒状体を弾力スラスト軸受手段でスラスト支持

する構造でも軸心保持が可能である。

【0017】ここに、上記モータ保持部が、インサート成形で一体化したヨーク相互のモールド樹脂材を以て同時に一体成形されて成るものであれば、部品点数の削減に寄与し、一層の低コスト化を実現できる。

【0018】また、上記スクリーシャフトの他端側の先端部には、機外の第2支持体の軸受面とピボット軸受を構成すべき球面ジャーナル部が一体的に突出した冠体を嵌着して成ることが好ましい。スクリーシャフトの他端側の玉受穴の切削加工を排除できることは勿論、冠着体自体が球面ジャーナル部を一体的に具備していることから、部品点数の削減に寄与し、低コスト化を実現できる。

【0019】この冠体は滑性プラスチック材質で成形されて成ることが好ましい。球面ジャーナル部の摩擦低減に寄与する。

【0020】上記の弾力付勢手段としては、玉押えの玉押し穴とは反対面の中心域周囲に略等間隔で先端部がそれぞれ圧接する複数の輻射状板バネ片を中心にに向けて一体的に持つリング板である。複数の輻射状板バネ片が均等した付勢力を以て玉押えの中心域周囲に加えているため、玉押えの姿勢自体を軸線と斉一化できるので、高精度な軸心保持を実現できる。

【0021】そして、上述したような螺子送り用モータとそのスクリーシャフトに螺合してその回転により軸方向に螺子送りされる従動部材を有して螺子送り機構をフロッピーディスクドライブ、ステルカメラ及びビデオカメラ等の電動機器に用いるに適している。

【0022】

【発明の実施の形態】次に、本発明の各実施形態を添付図面に基いて説明する。

【0023】【実施形態1】図1は本発明の実施形態1に係る螺子送り用モータを用いた螺子送り機構を示す縦断側面図である。なお、図5に示す部分と同一部分は同一参照符号を付し、その説明を省略する。

【0024】本例の螺子送り用モータ（小形ステッピングモータ）は、PM形インナーロータ30の筒孔30aに基端側を圧入し、全長に雄螺子部31aを持つスクリーシャフト31とを有している。このスクリーシャフト31は転造螺子棒材を所定寸に切断して用いた転造スクリーシャフトである。また、PM形インナーロータ30はネオジ又はサマリウム鉄チツソ等のプラスチックマグネット成形品であって、有底筒状体となっている。そして、有底筒状体の底部30bの外周回転中心を調心規制するスラスト軸受機構40と、このスラスト軸受機構40を介してPM形インナーロータ30を軸方向（スクリーシャフト31の先端方向）に常時弾力付勢する弾力付勢手段たるリング板50とを有している。

【0025】スラスト軸受機構40は、底部30bの外周側中央に調心玉（鋼球）3を当ててPM形インナーロー

ータ30をスラスト支承するものであって、底部30bの外周の中心域に形成した略テーパ状の玉受穴30c

と、この玉受穴30cに収めた調心玉3と、その調心玉3を軸方向へ押圧するための略テーパ状の玉押し穴32aを具備する玉押え32とを有して成る。

【0026】ここで、PM形インナーロータ30の玉受穴30cの立体角（約120°）は玉押え32の玉押し穴32aの立体角（約60°）よりも大きくなっている。また、PM形インナーロータ30において、玉受穴30cと筒孔30a内側とを軸方向に連通する貫通部30dが形成されている。この貫通部30dはグリス溜まりとして用いられる。玉押え32は滑性プラスチック材質の成形品である。

【0027】玉押え32はケース兼のカップ状アウターヨーク5の底面に突出する絞り筒状部5aの筒孔に軸方向遊動可能に挿入する嵌合部32bと、抜け止めする鍔状部32cとの一体成形品である。図2（A）及び図3に示す如く、嵌合部32bにはリング板50の複数の輻射状板バネ片50aに対応する位置決め溝32dが形成されている。リング板50はカップ状アウターヨーク5の底面から内側に切り起こした5極の極爪（クロポール）5bに位置決めされて、位置決め溝32dに嵌まり鍔状部32cの中心域周囲に略等間隔で先端部がそれぞれ圧接する複数の輻射状板バネ片50aを中心にに向けて一体的に有している。

【0028】モータ本体のアウターステータは、上記のカップ状アウターヨーク5の外、こカップ状アウターヨーク5の開口を塞ぎ、図2（B）に示す如く、内側に切り起こした5極の極爪（クロポール）7aを持つ蓋状アウターヨーク7と、カップ状アウターヨーク5内でその極爪5b間に極爪8aが位置決めされる王冠状の第1のインナーヨーク8と、カップ状アウターヨーク5内で蓋状アウターヨーク7の極爪7a間に極爪9aが位置決めされる王冠状の第2のインナーヨーク9と、A相を構成する巻線コイル11と、B相を構成する巻線コイル12とを有している。第1のインナーヨーク8と第2のインナーヨーク9とはインサート成形でモールド樹脂13で一体化されており、そのモールド樹脂13が絶縁層も兼用している。また、インサート成形時にはモールド樹脂13で端子台14とモータ保持部60とが同時に形成される。端子台14には端子ピン14aが植立している。

【0029】この樹脂製のモータ保持部60は、モータ本体の端部において、スクリーシャフト31が遊隙隙間60aを以て遊貫し、フレームの起立片20aの取付穴に嵌合位置決めされるものである。モータ保持部60は蓋状アウターヨーク7の極爪7a間に嵌まる位置決め突起60bを有している。

【0030】このような構成の螺子送り用モータを図1に示す螺子送り機構に用いる場合、スクリーシャフト31の先端側が玉受穴2c、鋼球23及び軸受21でス

ラスト支持されるので、本例のように、基端側にスラスト軸受機構40だけを具備し、従来のメタル軸受6を具備しない。部品点数の削減を図ることができる。本例では、PM形ロータマグネット30の有底筒状体の底部30bを支承する構造であるため、スクリーシャフト31自体の基端面に切削加工により玉受穴を形成する必要がなく、また安価な転造スクリーシャフトを使用することができるので、低コスト化を実現できる。スクリーシャフト31の径よりも太い有底筒状体の底部30bに調心規制のための玉受穴30cを樹脂成形で形成する方が製造コストを低廉化できる。また、モータの小形化に寄与する。

【0031】PM形ロータマグネット30側の玉受穴30cの立体角が玉押え32の玉押し穴32aの立体角よりも大きくなっているため、玉受穴30c側の接触円の方が玉押し穴32aの接触円よりも大きいため、調心玉3と玉押し穴32aとの間で滑りを生じる。従って、PM形ロータマグネット30に対して調心玉3が動かないので、マグネット30の磨減が生じ難い。特に、PM形ロータマグネット30がネオジ等のプラスチックマグネットであるため、摩擦係数が大になり、その分、調心玉3とPM形ロータマグネット30とが摺動し難くなり、好都合である。これに加え、玉押え32が滑性プラスチックであるため、尚更、PM形ロータマグネット30と調心玉3との間には摺動が生じ難い。そしてまた、貫通部30dが給油孔（グリス溜まり）として利用されているので、グリスに調心玉3に付着しモータ保持部60はスクリーシャフト31の周面に非接触であるため、摺動損失を低減でき、出力トルクの向上に寄与する。また、非接触であるため、スクリーシャフト31をシャフト全長が雄螺子部である転造スクリーシャフト31を用いることができ、一層の低コスト化を実現できる。特に、スクリーシャフト31をPM形ロータマグネット30に圧入する深さを変えることにより突出する雄螺子部31aの長さを変えることができるため、雄螺子部31aの長さが異なる螺子送りモータに対してスクリーシャフト31を共用でき、低コスト化も実現できる。

【0032】このモータ保持部60はインサート成形で一体化したヨーク8、9相互のモールド樹脂材を以て同時に一体成形されて成るものである。従って、部品点数等の削減に寄与し、一層の低コスト化を実現できる。なお、蓋状アウターヨーク7も上記インサート成形で同時に一体化しても良い。組み付け工数の削減に寄与する。

【0033】リング板50は玉押え32の鏑状部32cの反対面の中心域周囲に略等間隔で先端部がそれぞれ圧接する複数の輻射状板バネ片50aを中心にに向けて一体的に有している。複数の輻射状板バネ片50aが均等した付勢力を以て玉押え32の中心域周囲に加えているため、玉押え32の姿勢自体を軸線と斉一化できるので、高精度な軸心保持を実現できる。

【0034】〔実施形態2〕図4は本発明の実施形態2に係る螺子送り用モータを用いた螺子送り機構を示す縦断側面図である。なお、図1に示す部分と同一部分は同一参照符号を付し、その説明を省略する。

【0035】本例の特徴としては、スクリーシャフト31の先端部に、切り起こし片20bの取付穴に嵌めた軸受23とピボット軸受を構成すべき球面ジャーナル部71が一体的に突出した冠体70を嵌着して成るところにある。この冠体70は滑性プラスチック材質の成形品である。このような冠体70を用いると、スクリーシャフト31の先端側の切削加工も排除できると共に、鋼球23も不要となるので、一層の低コスト化を実現できる。また、滑性プラスチック材質を用いているので、摩擦低減に寄与する。本例のその他の作用効果は、実施形態1と同様である。

【0036】なお、上述したような螺子送り用モータを用いた螺子送り機構は、フロッピーディスクドライブ、スチルカメラ及びビデオカメラ等の電動機器に用いるに適している。

【0037】

【発明の効果】以上説明したように、本発明は、スクリーシャフトの基端を弾力スラスト軸受手段で支承するのではなく、スクリーシャフトが挿嵌するPM形インナーロータの有底筒体の底部を弾力スラスト軸受手段で支承するところに特徴を有するものであるから、次のような効果を奏する。

【0038】① スクリューシャフト自体の端面に切削加工により玉受穴を形成する必要がないので、低コスト化を実現できる。また切削加工に不向きな細径のスクリーシャフトを用いることもできるため、モータの小形化に寄与する。

【0039】② スラスト軸受手段において、PM形ロータマグネット側の玉受穴の立体角が玉押し穴の立体角よりも大きい場合、PM形ロータマグネットに対して調心玉が動かないので、マグネットの磨減が生じ難い。特に、PM形ロータマグネットがプラスチックマグネットを用いると、摩擦係数が大になり、その分、調心玉とPM形ロータマグネットとが摺動し難くなる。また玉押し穴側を滑性プラスチックで成形すれば、尚更、PM形ロータマグネットに対して調心玉が動かない。

【0040】③ 玉受穴と筒孔内側とを軸方向に連通する貫通部を有して成る場合、この貫通部を給油孔（グリス溜まり）として用いることができる。貫通部内のグリスに調心玉が付着するので、尚更、調心玉がPM形ロータマグネットに対して動き難くなる。

【0041】④ モータ本体の端部に、スクリーシャフトが遊貫隙間を以て遊貫し、機外の第1支持体の取付穴に嵌合位置決めされるモータ保持部を有して成る構成によれば、モータ保持部はスクリーシャフトの周面に非接触であるため、摺動損失を低減でき、出力トルクの

向上に寄与する。スクリューシャフトのうちモータ本体外へ突出せる他端側部分のみが雄螺子部である場合に限らず、シャフト全長が雄螺子部であっても差支えない。かかる場合、転造螺子棒材を所定寸に切断した転造スクリューシャフトを用いることが可能となるため、切削螺子加工を排除することができ、大幅な低コスト化に実現できる。

【0042】⑤ 特に、スクリューシャフトをPM形ロータマグネットに圧入する深さを変えることにより突出する雄螺子部の長さを変えることができるため、スクリューシャフトの共用化により低コスト化も実現できる。

【0043】⑥ モータ保持部がインサート成形で一体化したヨーク相互のモールド樹脂材を以て同時に一体成形されて成る場合、部品点数の削減に寄与し、一層の低コスト化を実現できる。

【0044】⑦ スクリューシャフトの先端部には、機外の第2支持体の軸受面とピボット軸受を構成すべき球面ジャーナル部が一体的に突出した冠体を嵌着して成る場合、スクリューシャフトの先端側の玉受穴の切削加工を排除できることは勿論、部品点数の削減に寄与し、低コスト化を実現できる。

【0045】⑧ この冠体は滑性プラスチック材質で成形されて成る場合、球面ジャーナル部の摩擦低減に寄与する。

【0046】⑨ 弾力付勢手段としては、玉押えの玉押し穴とは反対面の中心域周囲に略等間隔で先端部がそれぞれ圧接する複数の輻射状板バネ片を中心にに向けて一体的に持つリング板である場合、複数の輻射状板バネ片が均等した付勢力を以て玉押えの中心域周囲に加えているため、玉押えの姿勢自体を軸線と斉一化できるので、高精度な軸心保持を実現できる。

#### 【図面の簡単な説明】

【図1】本発明の実施形態1に係る螺子送り用モータを用いた螺子送り機構を示す縦断側面図である。

【図2】(A)は同螺子送り用モータを示す背面図、(B)は同螺子送り用モータを示す平面図である。

【図3】同螺子送り用モータにおけるリング板と玉押えとの関係を示す切断平面図である。

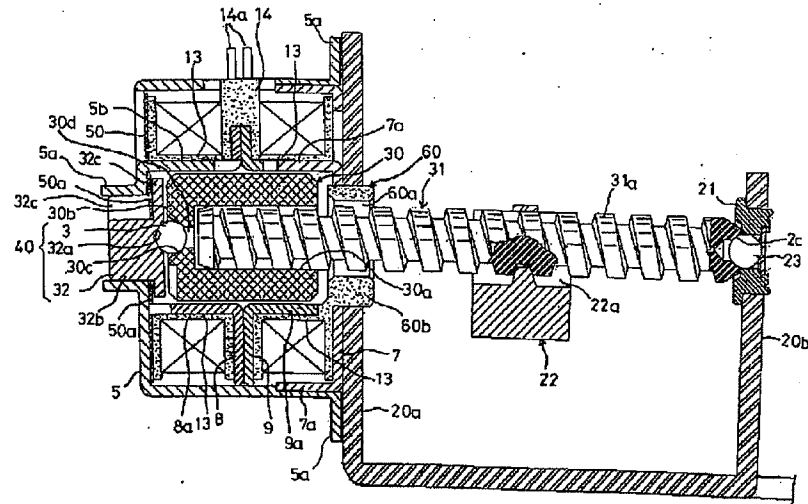
【図4】本発明の実施形態2に係る螺子送り用モータを用いた螺子送り機構を示す縦断側面図である。

【図5】従来の螺子送り用モータを用いた螺子送り機構を示す縦断側面図である。

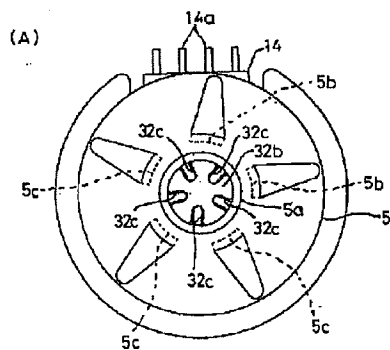
#### 【符号の説明】

- 1, 30…PM形(永久磁石形)インナーロータ
- 2, 31…スクリューシャフト
- 2a, 31a…雄螺子部
- 2b, 2c, 30c…玉受穴
- 3, 23…鋼球(調心玉)
- 4…板バネ
- 5…カップ状アウターヨーク5
- 5b, 7a, 8a, 9b…極爪(クロポール)
- 6…軸受メタル
- 7…蓋状アウターヨーク
- 8…第1のインナーヨーク
- 9…第2のインナーヨーク
- 11, 12…捲線コイル
- 13…モールド樹脂
- 14…端子台
- 14a…端子ピン
- 20a…フレームの起立片
- 20b…起こし片
- 22…ヘッドキャリッジ
- 22a…雌螺子部
- 30a…筒孔
- 30b…底部
- 30d…貫通部
- 32…玉押え
- 32a…玉押し穴
- 32b…嵌合部
- 32c…鏝状部
- 32d…位置決め溝
- 40…スラスト軸受機構
- 50…リング板
- 50a…輻射状板バネ片
- 60…モータ保持部
- 60a…遊貫隙間
- 60b…位置決め突起
- 70…冠体
- 71…球面ジャーナル部。

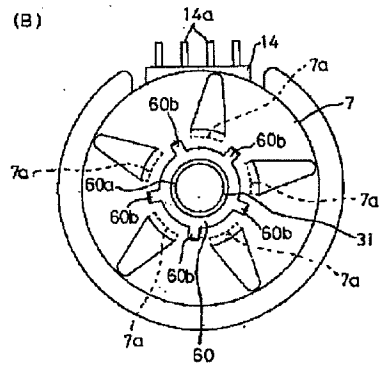
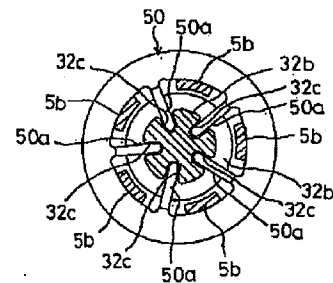
【図1】



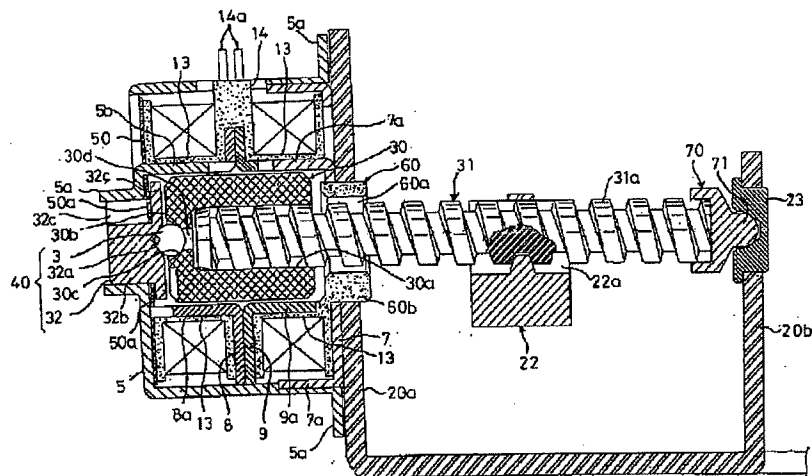
【図2】



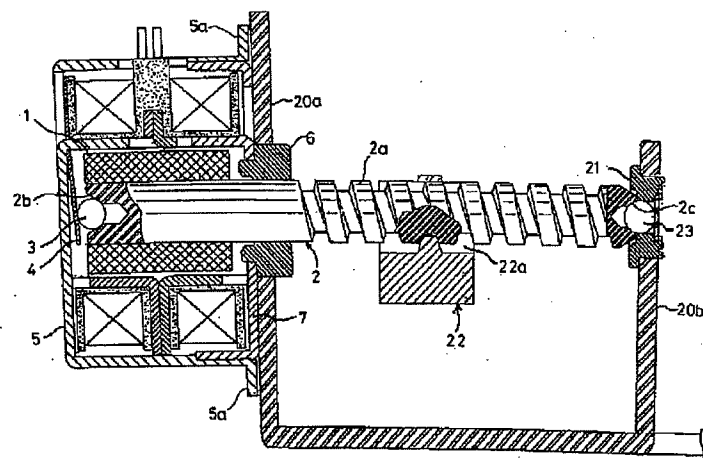
【図3】



【図4】



【図5】



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